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SHORT LISTING

Organic Chemistry

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ISOMERS

Conditions for geometrical isomerism
1- C=C 2- atoms attached to C=C must be different

No. of geometrical isomers = 2^n ⟹ n = no. of π-bonds.

* Possible Isomers for alkanes

C_4	2
C_5	3
C_6	5
C_7	9
C_8	18
C_9	35
C_{10}	75

⇦ If monovalent Functional group is present,

Isomers = possible isomers × 2 *

e.g $C_5H_{11}OH = 3 \times 2 = 6$ isomers.

* If more than one group is present, this trick will not apply

e.g $C_2H_2Cl_2$ ⇒ 2 groups attached.
geometric isomers = 2 Total isomers = 3

POSITIONAL ISOMERS

* must be monovalent (1 C-atom پر 1 attach F.G)

e.g double & triple bond and OH group

$CH_2=CH-CH_2-CH_3$
1-Butene

$CH_3-CH=CH-CH_3$
2-Butene

METAMERS

* must be divalent (2 C-atoms پر 2 attach F.G)

e.g ether-ether
ketone-ketone
ester-ester.

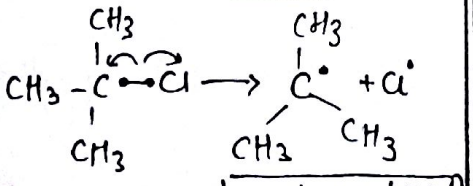
$CH_3-CH_2-O-CH_2-CH_3$

$CH_3-O-CH_2-CH_2-CH_3$

Alkenes and alkynes don't show metamerism

Homolytic Cleavage

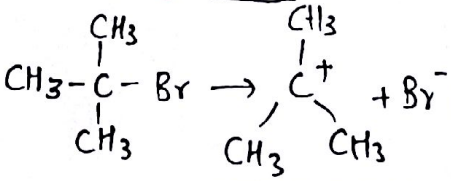
equal distribution of ēs
* free radicals produced
unpaired ēs
⇒ Paramagnetic



carboradical

Heterolytic Cleavage

unequal distribution of ēs
* cations > anions formed
Paired ēs
⇒ Diamagnetic



carbocation

* Stability of Intermediate product ∝ reactivity of reactant.

* stability of reactant ∝ $\frac{1}{\text{reactivity of reactant}}$

π-bond cleavage

· addition reaction
No. of π-bonds in reactant > no. of π-bonds in product

σ-bond cleavage

· substitution reaction
No. of π-bonds in reactant = No. of π-bonds in product

STABILITY ORDER

Carbocation	3° > 2° > 1°
Carboradical	3° > 2° > 1°
Carbanion	1° > 2° > 3°
Alkoxide ion ($R-O^-$)	1° > 2° > 3°

REACTIVITY ORDER

Alcohol with C-O cleavage	3° > 2° > 1°
Alcohol with OH bond cleavage	1° > 2° > 3°

IUPAC SYSTEM

{C=C, C≡C} If at same position, priority ⇒ C=C

{C=C, C≡C} If at diff position, کم نمبر والا پہلے آئے گا

Parent name remains same "en-yne"

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Substitution Reactions

Electrophilic
- Alkylation, Acylation, Sulphonation, Nitration } of benzene
- Alcohol & Carboxylic acid when OH bond cleavage
- Halogenation of alkyl benzene when in presence of catalyst

Nucleophilic
- S_N1 and S_N2
- Alkyl halide with aq. KOH
- Alcohol & Carboxyl group when C-O bond cleavage

Addition Reactions

Electrophilic
- Alkene and alkyne reactions
- Hydrogenation of benzene
- Halogenation of benzene in presence of sunlight hν

Nucleophilic
- Reactions of aldehydes and ketones.

Aromatic aldehydes and aromatic ketones DONOT have IUPAC names

Disubstituted Benzene
PRIORITY LIST

1 – COOH	5 – OH
2 – CN	6 – NH_2
3 – CHO	7 – OR
4 – COR	8 – R

common name	IUPAC
Aldehyde	Alkanal
Ketone	Alkanone
Carboxylic acid	Alkanoic acid
Ether	Alkoxy alkane
ester	Alkyl Alkanoate
Acid halide	Alkanoyl halide
Alkyl cyanide	Alkane nitrile

The functional group Imine is also called Stiff base

Halogenation of alkanes
- sunlight can't break C-C or C-H bonds.
- only breaks Cl-Cl or Br-Br.

Dehydrohalogenation
Hydrogen is removed from where it is less in no. and added where it is greater in no. to form stable carbocation.

Reactivity Order
Alkene > Benzene > Alkyne > Alkane

BROMINE-WATER TEST
Br_2/CCl_4 (reddish brown)
- → Alkene] turn
- → Alkyne] colorless
- → phenol] form white ppt.

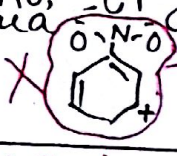
KMnO4 Test (Bayer Reagent)
- → Alkene → Alcohol
- → Alkyne → Aldehyde → Ketone
- → Alkyl Benzene

color of KMnO4 discharged

Bayer Regent
1:/ alkaline $KMnO_4$ OR dilute acidified KMnOH

BOND LENGTH
C-C
- alkane = 1·54A°
- Benzene = 1·397A°
- alkene = 1·34A°
- alkyne = 1·20A°

Resonating Structures of Benzene
Meta charge +ve یا -ve کی طرف
ortho, para الیکٹرون پر نہیں آتا



This structure is WRONG

when functional group is same;

Reactivity of Alkyl Halide
C-I > C-Br > C-Cl > C-F

Reactivity Order of Derivatives of Benzene
o, p benzene > benzene > halo-benzene > meta-benzene

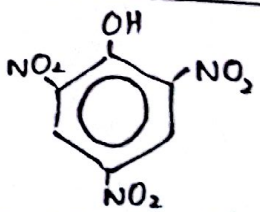
No. of C-atoms ∝ reactivity

LUCAS TEST
lucas regent → conc. HCl / $ZnCl_2$
- *C-O bond cleavage
- Reactivity of Alcohol 3° > 2° > 1°
- 3° alcohol → immediately forms oily layer
- 2° alcohol → 5-10 mins late
- 1° alcohol → forms layer on heating

IODOFORM TEST
Iodoform regent $I_2/NaOH$ or I_2/Na_2CO_3

Type of oxidation reaction

Test given by:
- Alcohols with β Methyl group except 3° alcohols
- Aldehyde / Ketones with α-Methyl group



2,4,6 Trinitrophenol
Picric acid
Stronger acid than carboxylic acid
pKa = 0·38

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Acidity of Phenol

*charge on O-atom $\propto \frac{1}{\text{acidity}}$

- no. of $\bar{e}$ donating group $\propto$ charge on O-atom
- no. of $\bar{e}$ withdrawing group $\propto \frac{1}{\text{charge on O-atom}}$

Acidity Order

Water > Methanol > ethanol

Acidity Order

$F-CH_2-\overset{O}{\overset{\|}{C}}-OH$ > Chloro acetic acid > Bromo acetic acid > Iodo acetic acid > acetic acid

*Halogens with benzene are $\bar{e}$ donating

*Halogens with Alkyl group are $\bar{e}$ withdrawing

$F_2CH-\overset{O}{\overset{\|}{C}}-OH > FCH_2-\overset{O}{\overset{\|}{C}}-OH$

$F-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-OH < CH_3-CH-\overset{O}{\overset{\|}{C}}-OH$

F → Yedoorh. F → Ye qareeb hai

General acidity order

$R-\overset{O}{\overset{\|}{C}}-OH > \text{C}_6\text{H}_5\text{OH} > H_2O > R-OH$

Conjugate base order

$R-O^- > O^-H > C_6H_5O^- > R-\overset{O}{\overset{\|}{C}}-O^-$

($NaHSO_3$) Sodium Bisulphite Test

given by:

- aldehydes & small methyl Ketones (acetone)

PKa values

phenol	10
formic acid	3.74
acetic acid	4.74
benzoic acid	4.20